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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacturing method of the filter for air bag inflators. It is a filter with which the inflator which is one of the parts which constitute in more detail the air bag which operates at the time of a vehicle collision is equipped, and is related with the manufacturing method of the filter which can filter the gas emitted inside an inflator at the time of an air bag operation, and can remove solid residue.

[0002]

[Description of the Prior Art] Now, the air bag which protects a crew member from a secondary collision is put in practical use at the time of the collision of vehicles, such as a passenger car and a truck. The sensor which this air bag detects the collision of vehicles quickly, judges the grade of a collision, and sends an active signal. It is made to expand by the gas which flows from the inflator made to generate gas with the active signal from this sensor, and this inflator, and comprises a bag which takes care of a crew member.

[0003] The inflator which is one of the parts which constitute the above-mentioned air bag is divided roughly into three kinds, a high pressure gas type inflator, a solid-propellant type inflator, and a hybrid type inflator, by the generation method of gas. The solid-propellant type inflator mainly used for the air bag for driver's seats also in this, The igniter lit with the active signal from said sensor, the generation-of-gas agent which burns explosively and generates gas by this igniter, and its storage part, It is common to equip the diffuser etc. which make the filter which filters the gas which has solid residue at the elevated temperature generated by explosive combustion of this generation-of-gas agent, and the gas which passed this filter flow in said bag.

[0004] As a conventional filter with which the above-mentioned solid-propellant type inflator is equipped, (1) Make a rotation rolling-up fixture stop the end of a band-like wire gauze, rotate this rotation rolling-up fixture at a fixed speed, and form a cylindrical body, What sampled this rotation rolling-up fixture from this cylindrical body, and prepared it to the hollow cylinder type after that, the thing which twisted and prepared the band-like wire gauze in the hollow cylinder type case where the (2) predetermined hole was drilled, etc. can be mentioned.

[0005]There was a fault that the filter of the conventional above (1) had low rigidity because of the structure which twisted the wire gauze and was used as the hollow cylinder object, and form collapsed easily by the shock at the time of a generation-of-gas agent burning explosively and gas being emitted. When manufacturing the filter of the above (2), it needed to prepare the hollow cylinder type case separately besides the wire gauze, the manufacturing cost increased not only a manufacturing process is complicated, but, and the structure of the manufactured filter also had further the fault of becoming complicated.

[0006]Since damage will be inflicted on a crew member if that deployment (expansion) speed is too quick, deployment will not meet the deadline if too late, and the air bag cannot take care of a crew member, it is required that this air bag should be developed at a proper speed according to the size of the vehicles equipped, structure, etc. Although this expansion speed could be adjusted with the kind of generation-of-gas agent, and quantity and the characteristic of a filter, in the manufacturing method of the above (1) and the conventional filter of (2), there was a fault that it was difficult to manufacture easily various filters according to the characteristic of various vehicles.

[0007]

[Problem to be solved by the invention]this invention person in view of the above-mentioned situation The rigid lowness of the conventional filter for air bag inflators, Solve the fault of the complexity of structure and it has the intensity which bears the shock of the combustion gas emitted explosively, The complicatedness of the manufacturing process at the time of removing solid residue, and passing combustion gas easily, and manufacturing this filter, A fault, like a manufacturing cost increases is solved, and as a result of repeating research wholeheartedly that the method of manufacturing easily the filter for air bag inflators of the various different characteristics further should be provided, it comes to complete this invention.

[0008]That is, the purpose of this invention is as follows.

1. Although structure is easy, it has the high rigidity which bears the shock of combustion gas, and provide the method of manufacturing the filter for air bag inflators which removes solid residue and passes combustion gas easily.
2. Provide the manufacturing method of the filter for air bag inflators with which a manufacturing process is not complicated and a manufacturing cost does not increase, either.
3. Provide the method of manufacturing efficiently the filter for air bag inflators of the various different characteristics.

[0009]

[Means for solving problem]In manufacturing the filter for air bag inflators in this invention, in order to solve the above-mentioned problem, Thickness the metal wire of the 0.50-1.0-mm-wide rectangular shape in section are 0.20-0.40 mm at least one. The manufacturing method of the filter for air bag inflators which twists around a fixture 300 to 5000 times, knits up into it out of the tension of 2 - 5kgf, considers it as a cylindrical body, and is characterized by sampling said fixture from this cylindrical body is provided.

[0010]

[Mode for carrying out the invention]Hereafter, this invention is explained in detail. The filter for air bag inflators manufactured by the manufacturing method concerning this

invention, A generation-of-gas agent is lit with the signal which went via the igniter from the sensor, the gas which has solid residue at the elevated temperature generated by explosive combustion of the generation-of-gas agent is filtered, and the function to cool simultaneously depending on the case is achieved. The appearance shape of this filter presents a hollow cylinder object, and the inflator in which the inclusion to the front air bag with which the steering wheel of a driver's seat is equipped, and the side air bag with which the door of a driver's seat or a passenger seat is equipped is possible is equipped with it.

[0011]The size of the filter of the shape of this hollow cylinder object can be suitably decided according to the structure and the size of the inflator equipped. For example, if the disk type inflator in which the inclusion to the above-mentioned front air bag is possible is equipped, If it can be referred to as 40-50 mm in inside diameter, the outer diameter of 60-70 mm, and 30-50 mm in length and the inflator in which the inclusion to a side air bag is possible is equipped, they are 20-30 mm in inside diameter, an outside of 40-50 mm, and 150-180 mm in length. As a kind of metal used as the material of this filter, iron, cast iron, soft steel, stainless steel, a nickel alloy, a copper alloy, etc. can be mentioned, and austenitic stainless steel (SUS304) is especially preferred.

[0012]The metal wire for the above-mentioned filter manufacture for air bag inflators is made into rectangular shape in section with a thickness [0.20-0.40 mm of], and a width of 0.50-1.0 mm, and its thing with a thickness [0.25-0.35 mm of] and a width of 0.60-0.80 mm also in this is preferred. It can obtain by rolling the metal wire of section round shape, for example, a section can roll the metal wire of the round shape which is 0.5 mm in diameter, and this metal wire can use it as the metal wire of width 0.65mm rectangular shape in section at 0.30 mm in thickness. The rolling can rotate the cylindrical roll of the upper and lower sides which attached the specific-shaped slot, for example, and can be performed by the method of making through the metal wire of the above-mentioned section round shape, and making the section into rectangular form among these rolls.

[0013]In order to manufacture the filter for air bag inflators, At least one above-mentioned metal wire is prepared, and it twists around a circular fixture 300 to 5000 times, and knits up into it out of the tension of 2 - 5kgf, and by welding etc., the section which made the proper place of the fixture stop the end of this metal wire, and cut it right-angled in the length direction joins to a proper place, and uses the end of a metal wire as a cylindrical body. As for the number of times to twist, it is preferred to decide in the range which does not make the gas which passes a filter produce remarkable pressure loss. Especially the desirable tension at the time of twisting around a fixture is 2.5 - 3.5kgf, and especially the desirable number of times at the time of twisting is 400 to 500 times. Since the above-mentioned fixture will make that diameter small and sampling of it will become possible from a metal wire after volume attachment of the above-mentioned metal wire is completed on the surface of this fixture if it is made into the structure where the circular diameter used as a section is changeable, it is preferred. As for the material of this fixture, it is common to consider it as metal, such as stainless steel, a copper alloy, and an aluminum alloy.

[0014]When twisting a metal wire around the above-mentioned fixture and knitting it up, the pressure loss of the gas emitted inside the filter can be controlled by explosive combustion of a generation-of-gas agent to a suitable value the thickness of a metal wire, a lacing-up pattern, and by twisting and changing various number of times etc. Prepare

one metal wire and this metal wire is made to guide with a guide implement as an example of this method of knitting up, A fixture can be rotated making this guide implement move reciprocately within the limits of the length of the filter to manufacture, and the method of twisting a metal wire around the position of the surface of a fixture, and knitting it up can be mentioned. With reciprocating movement of the above-mentioned guide implement, a metal wire can be twisted around a fixture at a fixed angle (henceforth a "contact angle") to the medial axis of a fixture.

[0015]changing various the above-mentioned contact angles and intervals (henceforth a "pitch") of the width direction ends of the metal wire which adjoins mutually when twisted -- the lacing-up pattern of a metal wire -- it can twist and density etc. can be made various. These contact angles and a pitch are variously changeable according to the width of a metal wire, etc. by adjusting suitably the ratio of the movement speed in the case of the round trip of a guide implement, and the revolving speed of a fixture.

[0016]If the above twists and lacing up is completed, the end of a metal wire will be joined as aforementioned, a fixture will be sampled from the obtained cylindrical body, and it will be considered as hollow cylinder object-like the filter for air bag inflators. After sampling a fixture from a cylindrical body, it can be used as a filter as it is, but sintering at an elevated temperature is preferred. Although the temperature at the time of sintering changes with the kind of metal wire, thickness, the number of times to twist, a pitch, contact angles, etc., it shall be performed in 500-1500 **. Also in this, the range of 1100-1200 ** is preferred.

[0017]The above-mentioned sintering is performed for the purpose of joining the portion which eases the internal distortion of the metal wire produced on the occasion of rolling, and a metal wire overlaps. As for sintering, it is preferred to carry out by putting into the electric furnace set as prescribed temperature, and, as for sintering time, it is preferred the kind of metal wire, thickness, and to choose in the range for 30 to 80 minutes, although it twists, the number of times twists and it changes with density, a pitch, sintering temperature, etc. Although sintering can also be performed in the air, it is preferred to carry out in a vacuum and inactive gas without a possibility of embrittling a metal wire or occurring a chemical reaction. As inactive gas, nitrogen gas, argon, etc. can be mentioned and nitrogen gas is especially preferred.

[0018]As a solid-propellant type inflator equipped with the above-mentioned filter, For example, an igniter lit with an active signal from a sensor, The above-mentioned filter etc. which filter gas emitted by generation-of-gas agent which is lit by this igniter and burns and this generation-of-gas agent storage part, and combustion of a generation-of-gas agent can mention structure equipped in a predetermined case, respectively. Two or more diffusers used as a tap hole of gas which passed the above-mentioned filter are prepared for a proper place of a case.

[0019]Although there is no restriction in particular as a kind of the above-mentioned generation-of-gas agent, a mixture of sodium azide and an oxidizer is typical. Since hot nitrogen gas is emitted by explosive combustion of a generation-of-gas agent, by equipping coolant independently, a filter and this filter can filter a solid residue to the above-mentioned inflator, and can quench hot nitrogen gas to it. An air bag equips the above-mentioned inflator, a sensor, and a bag at least.

[0020]When vehicles get a shock more than fixed by collision, the above-mentioned air bag, (1) A sensor which has detected the shock sends an active signal to the above-

mentioned inflator, (2) with this active signal, an igniter of the above-mentioned inflator lights, a generation-of-gas agent burns explosively, and gas is emitted -- (3), after passing a filter which requires this gas for this invention and removing a solid residue, It will flow into a bag, and will operate in an order of expanding this bag quickly, and a crew member will be taken care of by this bag that expanded.

[0021]

[Working example]Hereafter, although this invention is explained in detail based on Drawings and the example of an examination, this invention is not limited to the following written examples, unless the meaning is exceeded.

[0022]With the manufacturing method concerning this invention, drawing 1 is a perspective view of an example of the manufactured filter for air bag inflators, and drawing 2, It is a partial expansion perspective view in the state where gas has passed the filter of drawing 1, and drawing 3 is a section perspective view of an example of the inflator which equipped the filter of drawing 1. Drawing 4 is a graph which shows the measurement result of the relation of the air flow rate of the example 1 of an examination thru/or the example 3 of an examination and pressure loss which carry out a postscript.

[0023]Drawing 1 shows the filter 10 for air bag inflators manufactured by the manufacturing method concerning this invention. This filter 10 is formed in prescribed time volume attachment ***** and a bell shape in predetermined width and the metal wire 20 of thickness. Drawing 2 shows the state where gas passes the crevice between the filters 10 of drawing 1 which twisted and knit up the metal wire in the direction of an arrow.

[0024]Drawing 3 shows the inflator 30 which equipped the filter 10 of drawing 1. The diffuser 32 is formed in the external disk type case 31. The inside of the disk type case 31 is equipped with the igniter 33, the generation-of-gas agent 34, its storage part 35, and the filter 10. The igniter 33 is connected to the sensor which is not illustrated. The generation-of-gas agent 34 is lit by the igniter 33, burns explosively, generates gas, and this gas passes along the breakthrough 36 drilled in the generation-of-gas agent storage part 35, and it flows into the filter 10. The gas which flowed into the filter 10 flows out of the diffuser 32, after being filtered and removing a solid residue, it flows into the bag which is not illustrated, and expands this bag.

[0025][The example of an examination]

The filter used for the example 1 of an examination - the example 1 of the <example 3 of examination> [preparation of filter] examination - the example 3 of an examination was prepared according to the following procedures. Roll the stainless lines of the shape of a round cross section 0.5 mm in diameter, and at 0.31 mm in thickness First, 0.63 mm (example 1 of an examination) in width. It is referred to as 0.65 mm (example 2 of an examination) in width at 0.30 mm in thickness, and is considered as the stainless lines of three kinds of 0.70 mm (example 3 of an examination)-wide rectangular shape in section at 0.28 mm in thickness, It twisted 400 times, these stainless lines were knit up, carrying out load of the tension of 3.0kgf to a fixture, subsequently this fixture was sampled, and a hollow cylinder object 47 mm in inside diameter, the outer diameter of 64 mm, and 30 mm in length was formed. Subsequently, under a nitrogen atmosphere, the hollow cylinder object which consists of these stainless lines was performed at 1150 **, it sintered with the electric furnace for 60 minutes, and three kinds of filters in which pitches differ were prepared. A pitch becomes so large that the width of stainless lines is

narrow, and serves as the example 1 of a descending blank test, the example 2 of an examination, and the example 3 of an examination.

[0026][Evaluation of a filter] The upper and lower sides of three kinds of filters prepared by the above-mentioned process were closed, and the flow sent the compressed air of the range of 0.5 - 1.0 m³/min to the centrum of the filter, observed the pressure loss situation to it, and showed drawing 4 the result at it. In drawing 4, a vertical axis is pressure loss (Pa), and a horizontal axis is an air flow rate (m³/min). As for 41, the filter of the example 2 of an examination and 43 are the measurement results about the filter of the example 3 of an examination the filter of the example 1 of an examination, and 42.

[0027]The following thing becomes clearer than drawing 4.

(1) In three kinds of filters with which pitches differ, all pressure losses over the same air flow rate differed. Specifically, pressure loss over the same air flow rate became small, so that a pitch of a filter was large (refer to the example 1 of an examination - the example 3 of an examination, the curve 41 - the curve 43).

(2) A pitch of a filter can be changed and pressure loss over the same air flow rate can be controlled to various values.

[0028][Preparation of a filter] A filter used for the example 4 of an examination - the example 6 of an examination was prepared according to the following procedures. First, at 0.30 mm in thickness stainless lines of width 0.65mm rectangular shape in section, It twisted 400 times, and knit up into having used it in the example 1 of an examination, and a fixture of the same kind, carrying out load of the tension of 3.0kgf, subsequently this fixture was sampled, and a hollow cylinder object 47 mm in inside diameter, an outer diameter of 64 mm, and 30 mm in length was formed. Subsequently, under a nitrogen atmosphere, a hollow cylinder object which consists of these stainless lines was performed at 0-1150 **, it sintered with an electric furnace for 60 minutes, and three kinds of filters were prepared.

[0029][Evaluation of a filter] A punching tube is inserted inside three kinds of filters prepared by the above-mentioned process, One length direction end of these filters was turned down, it laid and fixed to the predetermined part, load was added from the upper part of the length direction end of another side, and these filters were made to compress 2 mm. Subsequently, the above-mentioned load was removed, the length of the restored filter was measured, and the difference (henceforth "the amount of restoration") with the length of the filter at the time of compression was computed. The ratio (henceforth the "recovery") of the variation (2 mm) of the filter at the time of compression and the amount of restoration was computed. These values were shown in table-1. If it exceeds especially 50% so that the recovery is large in this compression test, it can be said that it is suitable as a product.

[0030]

[Table 1]

表-1

項目 番号	焼結温度 (℃)	フィルターの長さ (mm)			圧縮量 (mm)	復元量 (mm)	復元率 (%)
		圧縮前	圧縮時	復元時			
試験例 1	0	30.0	28.0	28.5	2.0	0.5	25.0
試験例 2	700	30.0	28.0	28.8	2.0	0.8	40.0
試験例 3	1150	30.0	28.0	29.2	2.0	1.2	60.0

[0031] The following thing becomes clearer than table-1.

(1) The filter which did not sinter, and the filter which sintered at 700 ** did not fill the recovery to 50% (refer to the example 4 of an examination, and the example 5 of an examination).

(2) The recovery of the filter which sintered at 1150 ** will be not less than 50% (refer to the example 6 of an examination), and sintering temperature understands that it is preferred to carry out above 1000 **.

[0032] The filter used for the example 7 of an examination, the example 7 of the <example 8 of examination> [preparation of filter] examination, and the example 8 of an examination was prepared according to the following procedures. First, at 0.30 mm in thickness the stainless lines of width 0.65mm rectangular shape in section, It twisted 400 times, and knit up, carrying out load of the tension of 3.0kgf to having used it in the example 1 of an examination, and a fixture of the same kind, subsequently this fixture was sampled, and two hollow cylinder objects 47 mm in inside diameter, the outer diameter of 64 mm, and 30 mm in length were formed. Subsequently, under hydrogen gas atmosphere or a nitrogen gas atmosphere (example 7 of an examination) (example 8 of an examination), this hollow cylinder object was performed at 1150 **, it sintered with the electric furnace for 60 minutes, and two kinds of filters were prepared.

[0033] [Evaluation of a filter] inside two kinds of filters prepared by the above-mentioned process, Having used it in the example 4 of an examination and a punching tube of the same kind were inserted, and one length direction end of these filters was turned down, it laid and fixed to the predetermined part, load was added from the upper part of the length direction end of another side, and these filters were made to compress 2 mm.

Subsequently, the load was removed, the length of the restored filter was measured, and the amount of restoration and the recovery were computed. These values were shown in table-2.

[0034]

[Table 2]

表-2

項目 番号	ガス	フィルターの長さ (mm)			圧縮量 (mm)	復元量 (mm)	復元率 (%)
		圧縮前	圧縮時	復元時			
試験例 4	水素ガス	30.0	28.0	28.4	2.0	0.4	20.0
試験例 5	窒素ガス	30.0	28.0	29.2	2.0	1.2	60.0

[0035] The following thing becomes clearer than table-2.

(1) The filter which sintered under hydrogen gas atmosphere did not fill the recovery to 50% (refer to the example 7 of an examination).

(2) The recovery of the filter which sintered under a nitrogen gas atmosphere will be not less than 50% (refer to the example 8 of an examination), and it turns out that it is preferred to perform sintering under a nitrogen gas atmosphere.

[0036]

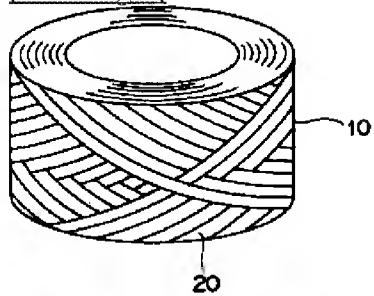
[Effect of the Invention] this invention is as having explained to details above, and is as follows -- doing an advantageous effect so specially, the industrial utility value is size very much.

1. According to the manufacturing method concerning this invention, twist and knit up out of a specific method the metal wire which has specific thickness, and depending on the case. Since it sinters on specific conditions and a filter is manufactured, it has high rigidity, although structure is easy, and the filter for air bag inflators which removes solid residue and passes combustion gas easily can be obtained.
2. Since according to the manufacturing method concerning this invention the metal wire which has specific thickness is twisted and knit up out of a specific method, it sinters on specific conditions depending on the case and a filter is manufactured, a manufacturing process is not complicated and a manufacturing cost does not increase, either.
3. According to the manufacturing method concerning this invention, twist and knit up out of a predetermined method the metal wire which has predetermined thickness, and depending on the case. Since it sinters on condition of predetermined and a filter is prepared, the filter for air bag inflators of the various different characteristics can be easily obtained by changing various the kind of the above-mentioned metal wire, the number of times to twist, a contact angle, pitches, and conditions of sintering.

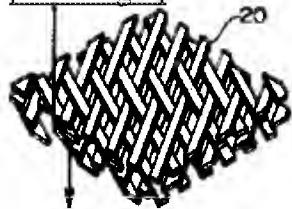
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DRAWINGS

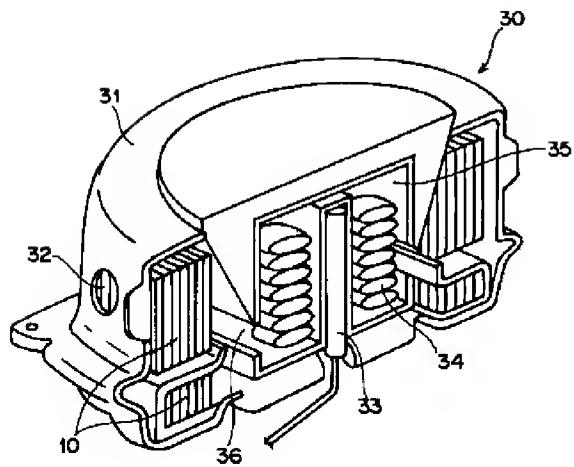
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Drawing 4]

